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ENDOCRINE CONTROL OF PROSTATIC CANCER[1,2]

By Dr. CHARLES HUGGINS

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THERE is a high incidence of abnormal growth processes—of tumors, in the prostate gland of certain species in senescence. These species are man, the dog and the lion. For technical reasons, observations can be carried out with greater facility on the first two types than on the king of the beasts.

The most common neoplasia involving the prostate gland are benign nodular hypertrophy and carcinoma. The benign hypertrophy has been found[3] to involve the prostate gland in 45 per cent. of men over forty years in otherwise unselected autopsy material. Cancer of the prostate occurs[4,5] in at least 9 to 17 per cent. of men over fifty years; while many of these tumors are microscopic in size and, remaining latent, seldom are factors in morbidity or mortality, others invade and spread and become the cause of death of about 5 per cent. of men older than fifty years[6] in the United States. Plainly, neoplastic processes are usually present in the human prostate gland after the fifth decade, while a normal prostate is less common in old white men. Barringer, an eminent student of prostatic cancer, recently stated:[7] "The control of prostatic carcinoma presents one of the most difficult problems in the field of cancer. Many urologists believe seriously that its control is impossible."

[1] Address delivered on the occasion of the first award of the Charles L. Mayer Prize administered by the National Science Fund of the National Academy of Sciences, May 19, 1943.

[2] This investigation was aided by a grant from the Committee for Research in Problems of Sex, the National Research Council.

[3] M. B. Teem, *Jour. Urol.*, 34: 692, 1935.

[4] A. R. Rich, *Jour. Urol.*, 33: 215, 1935.

[5] R. A. Moore, *Jour. Urol.*, 33: 234, 1935.

[6] E. Baron and A. Angrist, *Arch. Path.*, 32: 787, 1941.

[7] B. S. Barringer, *Surg. Gynec. and Obst.*, 62: 410, 1936.

The prostatic cancers most commonly encountered consist either of undifferentiated sheets of cells or of adenocarcinomas wherein tiny glands are reproduced. These types have been observed in a very few animals, namely in one monkey[8] and three dogs,[9] and have not been produced experimentally. In rats, the implantation in the prostate of the carcinogen, 1 : 2, benzpyrine, was followed by squamous carcinoma,[10] a type rarely encountered in man; adenocarcinoma has not been reproduced experimentally.

The prostate is not known to produce a hormone and a considerable function of the gland is external secretion. The nature of the external secretion is of importance, since this fluid contains several unusual components; what seems bizarre is of the greatest interest to scientists, far overshadowing routine and predictable phenomena. Human prostatic fluid contains rather large amounts of calcium,[11] citric acid[12] and two enzymes, fibrinolysin—a moiety capable of rapidly destroying fibrin[13] and acid phosphatase, an enzyme of some importance, as will be seen.

The prostate gland is dependent for its existence in the adult or secretory state upon endocrine products and as far as is known upon only two types of hormones, androgens and estrogens. The male sex hormones or androgens cause an increase of size and the initiation and maintenance of the function of prostatic epithelium and in excess produce, fundamentally, hyperplasia. The estrogens, or female sex hormones in excess, cause a decrease in size and cessation of function of the tall columnar secretory epithelial cells —metaplasia. Further these fat-soluble compounds have the interesting physiological capacity of neutralizing the action of each other with respect to the prostate, when administered in appropriate amounts; nothing is known of the mechanism of antagonism of androgens by estrogens except that it is not a neutralization in the sense that acid neutralizes alkali. These basic reactions of the prostate to hormones may be easily demonstrated by the surgical procedure of prostatic isolation in dogs,[14] which permits frequent assay of the prostatic secretion for many months.

One of the directions that cancer research now is taking is the functional or physiological approach to the problem of tumors. The functional approach contrasts sharply with the descriptive approach—with the methods of classical pathology. It is concerned with the entire living organism rather than with sections or segments of the dead organism. In the functional approach the measure is of first importance: How much cancer activity is present? How can the activity be increased or decreased? Assay of a disease in a laboratory obviously removes much of the uncertainty inevitably associated with bedside observation, particularly in cancer. The yardstick in prostatic cancer concerns certain enzymes, the phosphatases.

"The metabolism of living cells is carried on by a diverse and intricate mosaic of enzyme catalysis. Under normal conditions and over the greater part of the life of the host, each tissue presents a steady and consistent enzymic pattern."[15]

The phosphatases are important in energy production in the cell. An enzyme capable of hydrolyzing phosphoric esters was discovered by Grosser and Husler[16] in intestinal mucosa in 1912; Robison[17] found that this enzyme was rich in growing bone and that it had its optimum activity at about pH 9. In certain bone diseases where there was abnormally increased osteoblastic activity, Kay[18] found that the "alkaline" phosphatase value of serum was abnormally increased; among these bone diseases is prostatic cancer which often metastasizes and involves bones, flourishing in this location.

Another phosphatase, with optimum activity at pH 5, was discovered in 1934, independently by Davies[19] and Bamann and Riedel,[20] in liver and kidney. Kutscher and Wolbergs[21] found that this "acid" phosphatase was rich in concentration in the prostatic secretion of man. The extensive and elegant studies of A. B. Gutman and Ethel Benedict Gutman have greatly elucidated the prostate-phosphatase relationships. The enzyme does not appear in appreciable amounts in human or monkey prostate tissue until puberty,[22] either naturally occurring or artificially induced with androgens,[23] when large amounts form. Cancer of the prostate also contains large amounts of the enzyme.[24] In certain patients with cancer of the prostate when the tumor has spread to lymph nodes or

[8] E. T. Engle and A. P. Stout, *Am. Jour. Cancer*, 39: 334, 1940.
[9] C. F. Schlotthauer and J. A. S. Millar, *Jour. Am. Vet. Med. Asn.*, 99: 239, 1941.
[10] R. A. Moore and R. H. Melchionna, *Am. Jour. Cancer*, 30: 731, 1937.
[11] C. Huggins, W. W. Scott and J. H. Heinen, *Am. Jour. Physiol.*, 136: 467, 1942.
[12] B. Scherstén, *Skand. Arch. Physiol.*, 74: suppl. 9, 1936.
[13] C. Huggins and W. Neal, *Jour. Exp. Med.*, 76: 527, 1942.
[14] C. Huggins, M. H. Masina, L. Eichelberger and J. D. Wharton, *Jour. Exp. Med.*, 70: 543, 1939.
[15] J. P. Greenstein, *Jour. Nat. Cancer Inst.*, 3: 419, 1943.
[16] P. Grosser and J. Husler, *Biochem. Zeits.*, 39: 1, 1912.
[17] R. Robison, *Biochem. Jour.*, 17: 286, 1923.
[18] H. D. Kay, *Brit. Jour. Exp. Path.*, 10: 253, 1929.
[19] D. R. Davies, *Biochem. Jour.*, 28: 529, 1934.
[20] E. Bamann and E. Riedel, *Zeits. für physiol. Chem.*, 229: 125, 1934.
[21] W. Kutscher and H. Wolbergs, *Zeits. für physiol. Chem.*, 236: 237, 1935.
[22] A. B. Gutman and E. B. Gutman, *Proc. Soc. Exp. Biol. and Med.*, 39: 529, 1938.
[23] A. B. Gutman and E. B. Gutman, *Proc. Soc. Exp. Biol. and Med.*, 41: 277, 1939.
[24] E. B. Gutman, E. E. Sproul and A. B. Gutman, *Am. Jour. Cancer*, 28: 485, 1936.

bone, acid phosphatase values are increased in the blood,[25,26] constituting an important diagnostic test when high values are obtained. In many patients with advanced prostatic cancer both phosphatases are increased in serum; alkaline phosphatase because the bones are frequently involved with resultant increased osteoblastic activity and acid phosphatase because the tumor is prostatic in origin. Gomori[27] demonstrated by an ingenious histochemical staining method that acid phosphatase is elaborated by the normal secretory cells as well as by cancerous prostatic epithelium.

It then became apparent that the increased phosphatase values of adult secretory prostatic epithelium represented a secondary sex characteristic of an enzymic nature, and that usually prostatic cancer cells were at such a mature level that secretion occurred; this was of interest since in the past most cancers have been conceived to be composed of tissue resembling embryonic or primitive epithelium. It was known that with the possible exception of the anterior lobe of the prostate of guinea pigs[28] all secretory prostatic epithelium in mammals underwent diminution in size and function when the androgens were reduced in amount or in activity. Therefore, it was necessary to determine the effect of vitiation of androgens on prostatic cancer.

In a series of patients with advanced prostatic cancer the androgens were reduced by surgical removal of the testes or by estrogen administration, using as a yardstick the elevated serum phosphatases which were determined at frequent intervals.[29] Characteristically in man, such androgenic reduction is accompanied by a sharp fall in the amount of acid phosphatase to or towards normal and by a slower rise of alkaline phosphatase which after some weeks likewise decreased. These changes in alkaline phosphatase values apparently reflect healing in the bony lesions. The converse obtains in that the injection of androgen increases acid phosphatase values in prostatic cancer and aggravates the disease.

The inhibition of prostatic cancer by androgen control is not limited to beneficial effects on enzymes in blood serum. Among the earliest changes occurring in man are an increased appetite and relief of pain, often within several days after initiating treatment.[30] It is striking to see patients emaciated from malignant disease develop a voracious appetite. Pain in advanced prostatic cancer usually is severe and requires sedatives; this pain often disappears soon after castration. The increased food intake and decrease of pain promote a sense of well-being and more tangibly a gain in weight and increased blood formation so that the anemia accompanying the tumor frequently disappears, still further interrupting the vicious circle of the cancerous disease. Often there is a pronounced decrease in size of the neoplasm so that the palpably involved tissues, wherever they may be, return to normal; in deep recesses this apparent disappearance of the disease may be well followed in roentgenograms. Several patients with paralysis due to involvement of the spinal cord or nerve trunks with this cancer have had a disappearance of the neurologic changes and a return to a normal functional state.[30,31]

There have been no adverse psychic effects encountered, but certain undesirable effects attend androgen control. After castration most people develop the vasomotor phenomena known as hot flushes identical with those which are physiologic in occurrence in women at the menopause. Following estrogen administration men develop pain and swelling of the breasts. Moreover, in both instances whatever sexual activity remains, commonly slight, is usually abolished.

All in all, the improvement occurring after castration or estrogenic administration in prostatic cancer far outweighs the undesirable effects. It must be emphasized that the results are not uniformly successful and that they fall into three groups; one group, less than 5 per cent. of patients received no or slight benefit from endocrine treatment; the other groups, larger and nearly equal in number, obtained respectively an improvement pronounced but unsustained (less than eighteen months), or a pronounced and more prolonged regression of the disease. The improvement is greater than palliation, when technically the patient is merely made more comfortable in the face of advancing disease. The benefit in prostatic cancer often includes disappearance of the tumor, at least in the gross, and is considered as neoplastic inhibition. In clinical patients, castration seems to give somewhat better results than occur from estrogenic therapy.

The failure cases, where either no or an unsustained improvement occurs, are of great interest. As stated, in some of these cases endocrine modification produces a temporary atrophy, both of the original tumor and of the spread, to be followed in some months by reactivation of the disease; the recrudescence is always greater in the metastases than in the primary tumor. This is a strange phenomenon[32] when the previously

[25] A. B. Gutman and E. B. Gutman, *Jour. Clin. Investigation*, 17: 473, 1938.
[26] B. S. Barringer and H. Q. Woodard, *Trans. Am. Asn. Genito-Urin. Surgeons*, 31: 363, 1938.
[27] G. Gomori, *Arch. Path.*, 32: 189, 1941.
[28] E. D. Sayles, *Jour. Exp. Zool.*, 90: 183, 1942.
[29] C. Huggins and C. V. Hodges, *Cancer Res.*, 1: 293, 1941.
[30] C. Huggins, R. E. Stevens and C. V. Hodges, *Arch. Surg.*, 43: 209, 1941.
[31] R. M. Nesbit and R. H. Cummings, *Jour. Am. Med. Asn.*, 120: 1109, 1942. B. G. Clarke and H. R. Viets, *Jour. Am. Med. Asn.*, 121: 499, 1943.
[32] C. Huggins, *Ann. Surg.*, 115: 1192, 1942.

hard, enlarged and nodular prostate gland becomes and remains soft and atrophic in the presence of the advancing neoplastic process elsewhere in the body. Clearly the prostatic tissue in bone marrow and lymph gland is located more strategically for its growth than in the original neoplastic site. Among possible causes of the failure cases are the production of significant quantities of androgen in extragonadal loci, as well as differences in the nature of original tumor. It has been established that varying, and at times, large, amounts of androgen are produced in the adrenal cortex of man; the adrenal androgens have been incompletely studied in prostatic cancer but obviously if significant amounts of androgens are produced in this region in certain patients, castration will effect incomplete regression of the tumor. It has been found that glandular types of prostatic cancer often but not always respond more favorably than undifferentiated tumors.

The urinary excretion of hormones in prostatic cancer has been studied.[33] The 17-ketosteroid excretion is reduced in amount as compared with vigorous young men, but not more so than in normal males of the same age group; following orchiectomy there is a decrease in their level followed in several weeks by a rise greater than the pre-operative values. The excretion of gonadotrophic agents is slightly increased after castration.

The concept of autonomy of the cancer cell in recent years has influenced thinking about cancer; according to this idea the malignant cell is dependent for its survival on few or no extraneous influences and proliferates even when solely dependent on catabolic effects of a starving host for its energy and growth. The present observations demonstrate that this concept is not general in application in the tumor field, since the prostatic cancer in man often is dependent on androgen for its survival.

In summary, it is possible by reducing the amount or the activity of circulating androgens to control, more or less but often extensively, far advanced prostatic cancer in large numbers of patients. In this special case, androgen control seriously disturbs the enzyme mosaic of the cancer cells at least with respect to the important energy producing protein-catalysts, the phosphatases. As a contribution to the problem of cancer treatment, it is well to emphasize that any interference with an important enzyme system of a cell, normal or malignant, will cause in that cell a decrease of size and function.

[33] W. W. Scott and C. Vermeulen, *Jour. Clin. Endocrinol.*, 2: 450, 1942. A. L. Dean, H. Q. Woodard and G. H. Twombly, *Jour. Urol.*, 49: 108, 1943.

COLORBLINDNESS AND THE DETECTION OF CAMOUFLAGE

By Dr. DEANE B. JUDD
NATIONAL BUREAU OF STANDARDS

ACCORDING to newspaper reports, colorblind observers have frequently been successful in spotting otherwise perfectly camouflaged positions. In order to show whether these reports can be believed, a brief analysis of the ways by which a normal observer can detect off-color camouflage must first be given.

NORMAL VISION

A normal observer can make color discriminations of three kinds: light-dark, blue-yellow and red-green. If a camouflaged position appears neither lighter nor darker, neither bluer nor yellower and neither redder nor greener than the surrounding terrain, the observer with his naked eye can not detect it because of its color; it is therefore perfectly colored and matches its background perfectly.

RED-GREEN BLINDNESS

The two most common forms of colorblindness are called deuteranopia and protanopia. Deuteranopes and protanopes are called colorblinds because they can not make red-green discriminations. To hide a position from such an observer as these it is sufficient to make it neither lighter nor darker, and neither bluer nor yellower than the background. It is not necessary to worry about whether the position is redder or greener than the surrounding terrain. These observers find it hard to pick out ripe strawberries from green or to pick out a rotten apple from a barrel of red apples, since the color differences involved are chiefly red-green differences. Since they can make yellow-blue discriminations quite as well as the normal observers, they are sometimes said to be only partially colorblind.

RED-GREEN WEAKNESS

There are two other forms of abnormal vision which have to be considered. They are forms of vision intermediate between normal vision and deuteranopia and protanopia, respectively. The form intermediate between normal vision and deuteranopia is known as deuteranomalous vision, that tending toward protanopia as protanomalous vision. There are more

anomalous observers of these types than there are partial colorblinds. About 2 per cent. of the male population would be classed as partially colorblind, and another 6 per cent. as anomalous, making altogether 8 per cent. abnormal. The protanomalous and deuteranomalous observers can make the three types of color discrimination possible for the normal observer, but their ability to make red-green discrimination is less than normal.

Other forms of colorblindness are relatively rare and associated with diseases of the eye; such eyes can not possibly compete with normal eyes for the detection of camouflage and can therefore be passed over. Likewise the fact that protanopes are distinguished from deuteranopes by being less sensitive to the long-wave (red) end of the spectrum than the normal observer has no separate special bearing on the detection of camouflage. But there is an important distinction between red-green blind and red-green weak observers, that is, between partially colorblind and anomalous observers which can conveniently be brought out by reference to an analysis of the ways by which a camouflaged position can be imperfectly colored.

Color for Camouflage

If a position is concealed by being covered with material having the same reflecting properties throughout the spectrum as the surroundings, then it can not be detected. Such concealment can be approximated, for example, by using the actual vegetation or dirt of the surrounding terrain, and these methods are recommended by the Engineers Field Manual wherever practicable. Cut branches, however, rapidly change color from wilting of the leaves, and dirt after a rainstorm because of difference in rate of drying out may be a giveaway, although the spectral character of the material is very similar to that of the surrounding terrain. These are examples of the most common way by which a camouflaged position becomes imperfectly colored; this way may be called the imperfect use of spectrally correct materials.

Because of the impermanence of natural materials for camouflage, paint containing more permanent colorants is widely used for camouflage. Various branches of the War and Navy Departments have issued color standards for such paints. In the formulation of such paints it is desirable to choose pigments having spectral characteristics similar to those of the elements of terrain which have to be matched, but whenever the pigments are different from those coloring the terrain, some differences in spectral reflectance have to be tolerated. Therefore, if a paint is prepared to match an element of terrain for a normal observer, there will be portions of the spectrum at which the reflectances nevertheless differ. By viewing the two through a selective filter transmitting such a portion of the spectrum, the normal observer, or any observer, would be able to see one lighter than the other, although viewed with the naked eye they would match perfectly. Color matches involving such invisible spectral differences are sometimes called pseudo matches, but a preferred terminology suggested by Ostwald is to refer to them as metamers or metameric pairs. Such pairs as exhibit marked spectral differences are called highly metameric, and are said to exhibit a high degree of metamerism. Whenever paint is used for camouflage some degree of metamerism must be tolerated; such camouflage, however accurately adjusted by the naked eye, is always open to detection by the use of selective filters, or by photographic means, the conspicuousness of the installation being proportional to the degree of the metamerism.

Thus, there are two ways in which camouflage paint may be wrong; the components may be combined in improper proportion, or they may themselves be spectrally inappropriate.

Reduction Systems of Vision

If a red-green-blind observer be shown a pair of samples which match to the normal observer, he will be unable to discriminate them. That is, normal metamers are also metamers for the red-green blind. On this account protanopia and deuteranopia are called reduction systems of vision. A red-green-blind observer fails to discriminate many pairs which are conspicuously different for the normal observer; and if the normal observer can not tell the color difference between two samples, neither can he. Therefore, if the camouflaged position be imperfectly colored solely because of choice of a spectrally imperfect material, there is no basis for expecting a red-green-blind observer to detect it.

The red-green weak observers, however, do not possess reduction systems. A metameric pair set up by a normal observer will usually be more or less off-match for a protanomalous or deuteranomalous observer. There is therefore a chance that an anomalous observer could with his naked eye detect a camouflaged position which would be undetectable by a normal or colorblind observer. But give the normal observer the correct spectral filter, and he could also detect the difference.

Effect of the Background

We have seen that a colorblind observer can not detect camouflage, which is at fault solely because of spectrally imperfect materials. Any advantage in substituting a colorblind for a normal observer must therefore rest in the detection of positions whose colors are imperfectly adjusted to that of the sur-

rounding terrain. Let us inquire if there are likely kinds of blunders in applying camouflage which would be easier for the colorblind observer to detect than the normal.

A fairly common scene within which it is required to conceal a position is made up of patches of reddish-brown earth and yellowish-green foliage. The variegated pattern composed of these patches is well adapted to the concealment of a position from a normal observer. Even though it be somewhat too light or too bluish, the normal observer could fail to detect it because of the larger red-green differences in the scene. But consider the appearance of the scene to a red-green blind. The normal green of foliage to him appears dark-yellowish brown; the normal reddish brown of earth also appears dark-yellowish brown to him. He is not sensitive to the red-green differences which for the normal produce a variegated pattern; instead he may see a nearly uniform yellowish-brown field. Any element of terrain which is too light or too bluish could be quite conspicuous to such an observer. It is therefore possible to believe that a colorblind observer may detect camouflaged positions not detectable by the normal observer.

Can Colorblindness Be Produced by Filters?

It is a natural question to raise whether this possible advantage of the colorblind can be duplicated by giving a suitable viewing filter to a normal observer. The filter required to suppress normal red-green discrimination is, of course, one which transmits only in the blue and yellow portions of the spectrum. If a filter could be found, for example, which transmits the double band 450 to 490 mμ and 560 to 585 mμ, it would render the red-green differences between grass and earth about one fifth as prominent and at the same time preserve about the same prominence of any yellow-blue differences. However, such a filter would transmit less than 10 per cent. of incident daylight, probably much less. It is a question whether any improvement in detection of lightness differences or yellow-blue differences would be obtained by a normal observer in this way even against a highly variegated red-green background. It should be noted that such a filter, although it would render a normal observer relatively blind to red-green differences, by no means makes him equivalent to either a protanope or a deuteranope. Such a filter would endow the subject of the experiment with a luminosity function having two separate maxima, one at about 470 mμ, the other at about 570 mμ, whereas the deuteranope has a nearly normal luminosity function whose maximum is at 555 mμ, and the protanope a similar function with the maximum shifted to about 540 mμ. It is possible to produce the phenomena of color blindness separately by means of filters, but they can not all be bestowed in this way upon a normal observer at the same time.

OBITUARY

WALTER BEAL ELLETT

Walter Beal Ellett, head of the department of agricultural chemistry at the Virginia Polytechnic Institute and chemist for the Virginia Agricultural Experiment Station, died in Blacksburg, Va., on May 12, 1943. Dr. Ellett was born at Central Depot, now Radford, Va., on November 11, 1874. He was graduated from Virginia Tech in 1894 and immediately made an instructor in chemistry, earning his master's degree in 1896. He went to Germany in 1900 and graduated from the University of Goettingen in 1904 with the M.A. and Ph.D. degrees. While in Germany he studied under Tollens, Wallach, Nernst and Fleischmann. He was made head of the agricultural chemistry department in 1915, succeeding the late Professor Robert J. Davidson. He had been chemist of the Virginia Agricultural Experiment Station since 1906. Dr. Ellett was a member of the American Chemical Society and a fellow of the American Association for the Advancement of Science. His research at Virginia Tech has resulted in practical contributions to the fields of soil fertility, nitrification, fixation of phosphoric acid by the soil and fermentation. His many researches have been published in the various scientific journals and as bulletins of the Virginia Agricultural Experiment Station.

H. H. Hill

Virginia Polytechnic Institute

RECENT DEATHS

Dr. Arthur Willis Goodspeed, professor emeritus of physics of the University of Pennsylvania, died on June 6 at the age of eighty-two years. Dr. Goodspeed was secretary of the American Philosophical Society from 1901 to 1935.

Dr. Albro David Morrill, professor of biology at Hamilton College from 1896 until his retirement in 1928 with the title emeritus, died on June 8 in his eighty-ninth year.

Dr. Fred W. Hinds, dean of the College of Dentistry of Baylor University, died on June 4 at the age of fifty-five years.

Sir Arthur Newsholme, from 1908 to 1919 principal medical officer of the London Local Government Board, died on May 17 at the age of eighty-six years.

Sir Arthur in 1919 was visiting professor of hygiene and public health at the Johns Hopkins University.

PROFESSOR GUIDO FUBINI, formerly professor of mathematics at the University of Turin and since 1939 a member of the Institute for Advanced Study at Princeton, N. J., died on June 6 at the age of sixty-four years.

THE death is announced of Dr. Peter Muehlens, director of the Hamburg Institute for Tropical Diseases. He was sixty-nine years old.

SCIENTIFIC EVENTS

FIELD TRAINING IN HEALTH EDUCATION AT CLEVELAND HEALTH MUSEUM

TWENTY-SEVEN students in health education from the University of North Carolina will work from August 9 to September 4 as interns at the Cleveland Health Museum to receive a course of instruction, do laboratory work and gain field experience in methods of health education, especially in health exhibits. Among those students are seventeen individuals who were awarded fellowships by the U. S. Public Health Service, from a grant made available by the W. K. Kellogg Foundation.

The four-week course at the museum is part of a three-months' supervised field experience required in addition to nine months' academic training in order to obtain the degree of master of science in public health. The postgraduate students come from sixteen states: Arizona, California, Colorado, Illinois, Indiana, Missouri, Nebraska, New Hampshire, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Washington and Wyoming. One student comes from Lima, Peru. Many have been already engaged in health work, such as directors of school cafeterias, teachers of physical education or home economics in colleges, assistant directors of state hospitals, nutritionists, etc.

The course will be conducted by Dr. Bruno Gebhard, who is director of the Cleveland Health Museum and an associate in health education at the School of Medicine of Western Reserve University.

Besides instruction in the principles and methods of visual health education the students will gain practical experience in three work units. The first one deals with ideas, facts, figures and manuscripts. Another unit is centered around designing, constructing and budgeting of exhibits. A third will handle placement, publicity, visitors' reaction and follow-up.

The museum's facilities, including exhibits, the workshops, the loan service and the film library, will be used for this training.

THE AMERICAN FOUNDATION FOR TROPICAL MEDICINE

THE medical advisory committee of the American Foundation for Tropical Medicine authorized grants to six North American medical schools amounting to $26,100 during the first quarter of 1943, according to a report by Dr. J. A. Curran, dean of the Long Island College of Medicine, executive director, at a meeting of directors of the foundation in New York City on April 14.

These grants, made possible by contributions and pledges for the current year of $60,100 by nineteen American corporations, are being used to strengthen teaching or research programs in tropical medicine and parasitology at the various schools. The approved projects were selected by the medical committee among a number of applications.

Medical schools to receive aid were: the College of Medicine of New York University; Medical School of Tufts College; School of Medicine of Tulane University; the Faculty of Medicine of the University of Manitoba; the College of Medicine of the University of Nebraska and the School of Medicine of Yale University.

Companies that have made contributions or formal pledges of support include: Abbott Laboratories; American Cyanamid Company; Ciba Pharmaceutical Products Corporation; Firestone Plantations Company; General Foods Corporation; Hoffmann-La Roche, Inc.; the Lambert Company; Lederle Laboratories; Eli Lilly and Company; Merck and Company, Inc.; National Carbon Company; Parke, Davis and Company; E. R. Squibb and Sons; United Fruit Company; William R. Warner and Company; Winthrop Chemical Company; Winthrop Products, Inc., and John Wyeth and Brother. Other applications are pending and those that are approved will be financed out of contributions.

The program of the foundation adopted at the annual meeting of members in January calls for the collection and disbursement of $100,000 among medical schools and scientific journals and for special projects which fall within its scope. Dr. Curran stated that the full sum of $100,000 would be needed to complete the program.

The officers of the foundation are: *President,* Lt. Col. Thomas T. Mackie, executive officer, Division of Parasitology and Tropical Medicine, Army Medical School; *Vice-president,* Dr. Willard C. Rappleye, dean of the College of Physicians and Surgeons, Columbia University; *Secretary,* Alfred R. Crawford, assistant to the president of Long Island College of Medicine; *Treasurer,* W. W. Lancaster, partner,

Shearman and Sterling; and *Executive Director,* Dr. Curran, president and dean, Long Island College of Medicine.

Members of the executive committee, in addition to the above officers, are: Dr. Theodore G. Klumpp, *President,* Winthrop Chemical Company, Inc., and Dr. Henry E. Meleney, professor of preventive medicine, College of Medicine of New York University.

The purposes for which the funds granted are being utilized are as follows:

Manitoba.—Traveling fellowship for professor of parasitology and tropical diseases.

New York University.—Salary aid for full-time instructor in tropical medicine and parasitology.

Nebraska.—For full-time technical assistant to assist teaching in student laboratories and staff research.

Tufts.—To employ clinical teaching fellow in tropical medicine.

Tulane.—Budgetary needs of department of tropical medicine which since 1940 has trained forty-one physicians from Central and South American countries, from Africa and from Asia.

Yale.—To supplement salaries of teachers and laboratory assistants in order to expand tropical medicine teaching.

RATIONING AND EXPERIMENTAL LABORATORIES

THE question of the procedure for obtaining rationed foods for experimental purposes has been raised by a number of research institutions. In order to help those having difficulty in satisfying their needs, the following note has been prepared by the Food Distribution Administration:

Amendment 18 to General Ration Order Number 5, issued on April 24, states that, "On and after May 1, 1943, any use of a rationed food for experimental, educational, testing or demonstration purposes is an industrial and not an institutional use." This amendment lists experimental laboratories as industrial users and therefore requires them to proceed as directed under the institutional and industrial users sections of the various ration orders.

An industrial user (laboratory) registers, either in person or by mail, with the local board serving the area in which his principal office is located and receives an allotment to enable him to obtain and use foods covered by food rationing orders.

An application for the opening of a new establishment (laboratory) or original application to obtain rationed commodities must be made on OPA Form R–315. Such application should be submitted to the local War Price and Rationing Board which serves the area in which the establishment (laboratory) or its principal business office is or will be located. The local board will forward the application with its recommendation and all supporting data to Washington for appropriate action.

An application by an industrial user (laboratory) for allotment of a specific rationed food must be made in the following manner:

Sugar: If the applicant (laboratory) used sugar in 1941, his allotment will be based on actual usage during that year. He must register on OPA Form R–310 and apply for his allotment on R–314. The local board shall take appropriate action.

If the applicant did not use sugar in 1941, his allotment will be granted by the local board in accordance with the ruling received from Washington where the petition shall be sent by the local board.

Coffee: A laboratory which uses coffee for experimental purposes is considered a Class "A" industrial user of coffee, *i.e.,* a "person who uses roasted coffee in the preparation of a beverage which he does not serve." He must apply to his local War Price and Rationing Board which shall determine his monthly allotments.

Processed Foods: The applicant shall register on OPA Form R–1308, and include a record of his historical use of processed foods on which subsequent allotments will be based.

Meat, Cheese, Butter and Edible Fats and Oils: The applicant shall register as an industrial user on OPA Form R–1605 and include a record of his historical use of foods rationed under Ration Order 16 and his inventory of such rationed foods as of March 28, 1943. Allotments will be issued accordingly.

Sections 1407.81 to 1407.95 of Ration Order 3 cover the industrial use of sugar. Sections 1407.1015 to 1407.10175 of Ration Order 12 cover the industrial use of coffee. Article VI of Ration Order 13 and Amendment 10 to that order cover the industrial use of processed foods. Article VII of Ration Order 16 covers the industrial use of meats, cheese, butter and the edible fats and oils.

Additional information as to the procedure for obtaining rationed foods for experimental purposes as well as copies of the various rationing orders, amendments and necessary forms may be obtained from local War Price and Rationing Boards.

TRAINING FOR WOMEN IN AERONAUTICAL ENGINEERING AT THE UNIVERSITY OF CINCINNATI

DETAILS of a special war-training program developed with the Goodyear Aircraft Corporation to prepare selected groups of college women for specific types of work with the Akron, Ohio, firm have been announced by the University of Cincinnati.

Sponsored by the Goodyear Corporation, the program, starting on July 1, will train young women in aeronautical engineering in the College of Engineering and Commerce to qualify them for employment as junior engineers. The company will carry the cost. Applicants must have attended college at least one year and have general aptitude for mathematics. W. S. Dowman, of the Goodyear Corporation, is re-

ceiving applications for enrolment at his office in Akron. He is the corporation's manager for salary personnel.

The students will receive six months' instruction at the University of Cincinnati, and at the end of this training will be employed in the engineering department of the Goodyear Company. While at the university, the students will receive not only free tuition but also board, lodging and spending money. Other groups of young women will come to the university for this training when the first class has completed its work.

Since the Goodyear Corporation was the pioneer in this country in the construction of dirigible balloons, both small blimps and monster rigid types, and, within recent years, airplane assemblies have been constructed at Akron, the students will be taught the basic principles of both airplane and airship design.

The work at the College of Engineering and Commerce of the University of Cincinnati will be under the supervision of Professor Bradley Jones, head of the department of aeronautical engineering. The subject-matter of the course has been planned by close cooperation between Professor Jones and the Goodyear Company.

CONVENTION OF PSYCHOLOGISTS

AN Intersociety Constitutional Convention of Psychologists met in New York on May 29 and 31. Twenty-six delegates were present from the American Psychological Association, the American Association for Applied Psychology, the Society for the Psychological Study of Social Issues, the Psychometric Society, the Society of Experimental Psychologists, the National Institute of Psychology, Section I of the American Association for the Advancement of Science, the National Council of Women Psychologists and the Department of Psychology of the American Teachers Association. Dr. Robert M. Yerkes, chairman of the Survey and Planning Committee, a subcommittee of the Emergency Committee in Psychology of the National Research Council, opened the convention as temporary chairman. The elected officers were Edwin G. Boring, *Chairman;* Alice I. Bryan, *Secretary;* Ernest R. Hilgard, *Vice-chairman;* Edna Heidbreder, *Vice-secretary.* The purpose of the convention was the consideration of the amalgamation or cooperation of existing psychological societies in the furtherance of their scientific and professional aims, especially in the war effort and in the promotion of national welfare after the war. The following motion was passed: "Moved, that, having given careful consideration to the various proposals placed before us, this convention records its decision that the objectives in view can be most effectively and economically achieved through a closer and more organic tie between the reconstituted present national psychological societies and their present affiliates." Dr. Ernest R. Hilgard was appointed chairman of a continuing committee to give precise verbal form to the will of the convention for submission to the constituent societies for their adherence.

COPERNICUS CELEBRATION AT THE POLISH INSTITUTE OF ARTS AND SCIENCES IN AMERICA

THE Polish Institute of Arts and Sciences in America presented on May 3, Polish Constitution Day, before a distinguished audience of about one hundred and fifty persons a Copernicus-Constitution Day memorial program. Five speakers participated in the program in which Copernicus was represented as a natural product of the highly developed Polish civilization which existed even early in the sixteenth century.

The historian, Professor Oskar Halecki, of the University of Warsaw, well known in American universities as a popular lecturer, presided in his capacity as director of the institute.

As first speaker on the program, the president of the History of Science Society, Louis C. Karpinski (mathematics, University of Michigan), indicated the place of Copernicus in the history of science. In the development of the printing press and a newly added western hemisphere, the way had been prepared for a new view of the celestial universe. A light touch was added for a popular audience by the references to the fact that the night life of the stars, particularly eclipses and other irregularities in the wanderings of the stars, contributed much to the developments of planetary astronomy.

The French astronomer, Professor Alexandre Koyre (Ecole des Hautes Etudes, Sorbonne; and Ecole Libre des Hautes Etudes, New York), presented a paper on "The Copernican Revolution in Astronomy." The speaker prepared some ten years ago a French translation of the "De Revolutionibus" by Copernicus. Professor Rafal Taubenschlag, who is known for his studies in ancient Roman law, presented "The University of Cracow in the Age of Copernicus." The purpose of the paper, "Polish Literature in the Age of Copernicus," by Professor Waclaw Lednicki, was to show that the astronomical literature in Poland is part of a larger literary movement. Professor Lednicki has held a chair of literature in Cracow, also in Brussels, and now lectures at Harvard University. The director of the Polish Institute, Oskar Halecki, gave the final paper entitled "From Copernicus to the Constitution of May 3, 1791."

L. C. K.

IN HONOR OF DR. TREAT B. JOHNSON

A TESTIMONIAL dinner to Dr. Treat B. Johnson, Sterling professor of chemistry at Yale University, honoring his long service at the university, was given on the evening of June 7 at the New Haven Lawn Club by his university colleagues in the department of chemistry and a group of his former students, who had received their Ph.D. degree for research in organic chemistry under his direction. Professor Johnson is retiring from active service this year with appointment to a Sterling professorship emeritus.

Dr. Johnson has been connected with Yale University continuously since 1894, when he registered as a freshman in the Sheffield Scientific School. He has completed forty-three years of active teaching service at the university, having received his Ph.D. degree in chemistry in 1901.

Speakers at the dinner were Dr. Charles H. Warren, dean of the Sheffield Scientific School and professor of mineralogy; Dr. Elmer V. McCollum, professor of biochemistry at the School of Hygiene and Public Health of the Johns Hopkins University; Dr. William T. Read, professor of chemistry at Rutgers College, and Dr. Arthur J. Hill, Whitehead professor of chemistry at the university.

In recognition of his long and outstanding work at Yale and his contributions to the fields of organic chemistry and biochemistry, Professor Johnson was presented with a complete Shaeffer writing desk equipment and a G.-E. Mazda fluorescent lamp.

SCIENTIFIC NOTES AND NEWS

DR. HERMAN LOUIS KRETSCHMER, of Chicago, was chosen president-elect of the American Medical Association to succeed next year Dr. James E. Paullin, of Atlanta, at a meeting in Chicago from June 7 to 9, of the House of Delegates. Dr. John J. Amesse, of Denver, was elected vice-president, and Dr. Josiah J. Moore, of Chicago, was elected to succeed Dr. Kretschmer as treasurer.

MAJOR GENERAL NORMAN T. KIRK has succeeded Major General James C. Magee as Surgeon General of the Army.

AT the commencement exercises of New York University on June 9, the doctorate of laws was conferred on Dr. George Dinsmore Stoddard, professor of psychology at the State University of Iowa for seventeen years, director of the Iowa Child Welfare Research Station and dean of the Graduate School. Dr. Stoddard is now New York State Commissioner of Education and president of the University of the State of New York. The doctorate of laws was conferred also on Dr. Herman H. Horne, professor of education emeritus. The degree of doctor of engineering was conferred on Lieutenant General Brehon Burke Somervell.

JOHN T. ZIMMER, curator of the department of birds of the American Museum of Natural History, New York, editor of *The Auk*, on May 24 received the honorary degree of doctor of science at the annual commencement of the University of Nebraska.

As announced in the proceedings of the North Carolina Academy of Science, Dr. H. S. Perry, of Duke University, has won the first prize award of the academy for a paper on "The Control of Starchy Contamination in Sweet Corn by the Use of the 'Gamete' Gene." This paper will be placed in the Inter-academy Contest for the Southeastern States, to be judged by a committee of the American Association for the Advancement of Science.

DR. MAX M. STRUMIA, of Bryn Mawr, Pa., has been awarded the Ward Burdick gold medal of the American Society of Clinical Pathologists for his work in connection with methods of preparing blood plasma.

THE Howard Taylor Ricketts Prize of the University of Chicago has been divided between Dr. Howard C. Hopps, instructor in pathology, and Dr. Leo R. Melcher, formerly assistant in immunology in the department of bacteriology and parasitology, now a student at Northwestern University Medical School.

THE Albert Gold Medal of the Royal Society of Arts, London, has been awarded to Sir John Russell, director of Rothamsted Experimental Station, which this year celebrates its centenary.

DR. A. HARDISTY SELLERS, medical statistician, Department of Health, Ontario, squadron leader, Royal Canadian Air Force, has been awarded the Professional Institute Medal of the Professional Institute of the Civil Service of Canada in recognition of the important contribution made by him in the study of hospital statistics in Ontario in connection with the cost of medical care.

THE following officers of the Stanford Chapter of Sigma Xi for the year 1943–44 were elected at a meeting of the chapter on May 13: *President,* Professor George W. Beadle, biology; *Vice-president,* Professor Hubert Schenck, geology; *Secretary-treasurer,* Professor H. M. Bacon, mathematics; *Assistant Secretary-treasurer,* Professor Willis H. Johnson, biology. New members and associates were initiated at a meeting on May 28, at which time an address on "Plant Distribution" was given by Dr. Douglas H. Campbell, emeritus professor of botany.

AT the final meeting of the Pittsburgh Physical Society for the 1942–43 season, which was held on June 3 at the Mellon Institute, the following officers were elected for next year: *President,* Dr. Sigmund I. Hammer; *Vice-president,* Dr. Sidney L. Siegel, and *Secretary-Treasurer,* Dr. Mary E. Warga. An address was delivered by the retiring president, Dr. O. Stern, on the "Corpuscular and Wave Properties of Molecular Rays."

THE National Association of Science Writers, meeting at the American Medical Association convention in Chicago on June 9, elected as president Robert D. Potter, of New York, science editor of the *American Weekly.*

AT the recent annual meeting of the Supervisory Board of the American Year Book, an organization composed of delegates from forty-five learned societies, Professor Marston Taylor Bogert, of Columbia University, the representative of the American Chemical Society, was reelected to the presidency of the board, and Rear Admiral George H. Rock, the delegate from the Society of Naval Architects and Marine Engineers, was reelected to the vice-presidency.

DR. DONALD B. KEYES, chief of the chemical industries branch of the Office of Production, Research and Development of the War Production Board, and Raymond E. Kirk, of the Brooklyn Polytechnic Institute, have been elected to three-year terms as councilors of the American Institute of Chemists, Chicago. Frederick A. Hessel, president of the Montclair Research Laboratories, has been named treasurer.

THE following officers for 1943–1945 of the Cincinnati Chapter of the Society of Sigma Xi were installed at a meeting of the chapter on May 28: *President,* John L. Rich, professor of economic geology; *Vice-president,* Dr. Hoke S. Green, associate professor of organic chemistry, and *Secretary-Treasurer,* Dr. Paul B. Arenson, professor of inorganic chemistry. Dr. C. A. Elvehjem, professor of agricultural chemistry at the University of Wisconsin, delivered the annual lecture. He spoke on "The Present Status of the Vitamin B Complex."

DR. MARION FAY, professor of physiological chemistry at the Woman's Medical College of Pennsylvania, has been appointed acting dean for the duration of the war to fill the vacancy caused by the commissioning of Dr. Margaret D. Craighill as major in the Medical Corps, U. S. Army.

DR. ESTHER CARPENTER, holder of the Elizabeth Clay Howald Scholarship at the Ohio State University, will return in July to Smith College where she has been appointed associate professor of zoology. She has been studying the effect of temperature on thyroid grown in tissue cultures.

DR. HERBERT S. BREYFOGLE, a fellow in legal medicine at Harvard Medical School, has been appointed instructor in pathology at the Washington University School of Medicine and pathologist to the St. Louis County Hospital. He will serve also as pathologist to the coroner of St. Louis County.

DR. CARL VOEGTLIN, first director of the National Cancer Institute, which was established in 1937, will retire from the U. S. Public Health Service on July 31. He has been with the service since 1913; was commissioned medical director in 1931, and has been in charge of all cancer research since 1937.

DR. EDWARD A. STRECKER, professor and head of the department of psychiatry at the Graduate School and the Medical School of the University of Pennsylvania, president of the American Psychiatric Association, has been named special consultant to the Secretary of War for the Air Forces of the United States Army. In this capacity, Dr. Strecker will act as adviser to War Secretary Henry L. Stimson on all questions relating to psychiatry in the Air Forces. Serving as a civilian adviser he will be on call at all times by the War Department.

THE California Central Fibre Corporation has appointed Dr. Dorothy Day plant physiologist in its department of plant research at Pisgah Forest, N. C.

JOHN A. FAUST has joined the staff of the Bakelite Corporation, unit of Union Carbide and Carbon Corporation, at the Research and Development Laboratories in Bloomfield, N. J.

DR. PHILIP S. WINNEK has become director of research of Pitman-Moore Co., Indianapolis, pharmaceutical and biological manufacturers.

DR. J. BEN ROBINSON, president of the American Dental Association, was the guest of Mexican dentists at the fourth Medico-Dental Convention in Mexico City in March. At the request of the State Department Dr. Robinson extended his trip to visit dental groups in the leading cities of Mexico. Dr. Daniel F. Lynch, chairman of the Pan American Relations Committee of the American Dental Association, accompanied Dr. Robinson.

DR. HUBERT G. SCHENCK, professor of geology, has been granted an indefinite leave of absence from Stanford University in order to accept a commission as major in the Army.

DR. RICHARD A. HOWARD has been appointed Second Lieutenant in the Army of the United States. He has been assigned to duty with the Army Air Forces as an aviation physiologist.

DR. PEYTON ROUS, of the Rockefeller Institute for Medical Research, writes: "All admit and most admire

the wild genius shown by the printer in his errors. Yet surely he should not have stated, in SCIENCE of June 4, page 505, that the castration of patients with inoperable prostatic cancer is followed by 'dramatic happiness.' The word was "happenings'."

THE *Journal* of the American Medical Association reports that Dr. Walter B. Cannon, professor emeritus of physiology of the Harvard Medical School, is the president of the American-Soviet Medical Society, a new group founded to meet an increasing demand for information about the results and achievements of Soviet medicine. Dr. Henry E. Sigerist, director of the Institute of the History of Medicine at the Johns Hopkins University, Baltimore, is the editor of a journal to be published by the society, to be known as the *American Review of Soviet Medicine*. Temporary offices of the society are at 130 West 46th Street, New York. Through meetings, the publication of a journal and the establishment of a library of information, the society keeps physicians of America and members of the allied professions informed on what problems Soviet colleagues are working and what is being done to solve these problems. The society will also send American medical books and periodicals to the Soviet Union to keep the Russians informed of scientific developments in this country and to stimulate closer cooperation between the medical corps of the two countries. As soon as conditions permit after the war, the society hopes to promote the exchange of students and to sponsor study hours in the two countries.

THE University of Rochester ultimately will receive an estimated $1,784,275 for use as a research fund through the will of Mrs. Bertha H. Buswell, of Buffalo. Her will directed that the money be used to establish the "Bertha H. Buswell and Dr. Henry C. Buswell Memorial" for research work by the department of internal medicine of the School of Medicine. This amount represents the residue of her estate and is subject to a life interest by her brother. The late Dr. Buswell bequeathed $900,000 for the use of the department of urology in the medical school.

THE Texas Dental College, Houston, Texas, has been made a part of the University of Texas and is now officially known as the School of Dentistry of the University of Texas.

THE Bausch and Lomb Optical Company has announced the successful casting of the largest prism ever made—an optical disc twenty-six inches in diameter, graduated in thickness from 1½ to 3¼ inches and weighing 260 pounds. It was made for the Burrell telescope in the Warner and Swasey Observatory of the Case School of Applied Science at Cleveland.

THE editor of *Chronica Botanica* states that word has been received from a trustworthy Swedish correspondent that the herbarium and library buildings of the Botanical Museum in Berlin-Dahlem were completely destroyed during an air raid on the night of March 1 and 2. Practically nothing had been evacuated. With the exception of the fern herbarium and part of the fungi everything is gone. According to an official statement, publication of *Die Natürlichen Pflanzenfamilien* and *Das Pflanzenreich* will be discontinued.

THE foundation by the Royal College of Surgeons, London, of a research chair in ophthalmology, tenable at the Royal Eye Hospital, Southwark, has been announced. It is the first chair of its kind in England and the hospital has undertaken to raise £40,000 for its permanent endowment. The holder of the chair (the appointment has yet to be made) will devote the whole of his time to clinical research at the hospital and laboratory work at the Royal College of Surgeons.

A CABLE to *The New York Times* states that two more historic houses have been given to Great Britain in trust for preservation, Sir Isaac Newton's birthplace, Woolsthorpe Manor, near Granthan, Lincolnshire, and St. John's Jerusalem in Sutton-at-Hone, Kent. The gift of Woolsthorpe Manor was made possible through the generosity of the Pilgrim Trust, whose purchase of the property a few months ago to turn it over to the nation had already been announced. Many of the original features of the Newton birthplace have been preserved.

THE *Times*, London, reports that tunnellers of the Royal Engineers who continue blasting and boring their way into the heart of the Rock of Gibraltar have discovered a cavern which may have been sealed for 20,000 years. The cavern is of extraordinary beauty, glimmering white, gray and red stalactite columns, resembling a cathedral with pulpit, chancel and organ-pipes. The chamber contains a lake of fresh water nearly forty yards long and from seven feet to twenty feet deep. The largest column is seven feet in diameter and forty feet high.

DISCUSSION

THE SCIENCE MOBILIZATION BILL

IN reply to the letter of Dr. L. C. Dunn appearing in SCIENCE for June 4 attacking the statements, "95 per cent. of our scientific and technical manpower and facilities are now highly organized and coordinated to the single end of advancing the war effort" and

"practically every laboratory in the nation is in the service of the nation," I cite William L. Laurence's studies[1] of January 3, 1943, in addition to my own.[2]

Mr. Laurence states that "of the university research workers, fully 96.5 per cent. are now directly engaged in war work, with only 700 full-time research workers still available for this purpose. Among the industrial research laboratories in the fields of physics; chemical, electrical, and mechanical engineering, 93 per cent. of the personnel is working on war assignments." Since January, the percentage is probably higher in each group.

Any one who has had to do with engaging the services of or has served on governmental committees to find scientific and technical personnel knows that it is almost impossible to find any one who is not engaged in the war effort. At the last national meeting of the American Chemical Society held in Detroit in April, 1943, the Employment Bureau for Chemists found that there were six employers or more for every qualified chemist looking for a position. The scarcity of physicists and other scientists is even greater, judging from the difficulty the Army and Navy and war industries are having in filling their needs.

There are 630,770 persons[3] registered in the National Roster of Scientific and Specialized Personnel as of April 24, 1943. Of this group, 399,179 are physicians, dentists and veterinarians with the balance distributed as follows:

Chemistry	80,605
Civil Engineering	34,053
Electrical Engineering	22,027
Mechanical Engineering	21,669
Physics	11,054
Mathematics	9,154
Geology	9,028
Economics	7,990
Chemical Engineering	7,967
Biology	7,170
Psychology	5,933
Radio Engineering	5,630
Aeronautical Engineering	4,825
Automotive Engineering	3,265
Naval Architecture	1,221

It is interesting to note that the physicians and dentists are exempt from any rulings of the Kilgore Senate Bill 702. One may point out also that the Kilgore Bill defines as "scientific and technical personnel" "any one who has completed any course of study in any college or university in any branch of science or its practical application or who has not less than an aggregate of six months' training or employment in any scientific or technical vocation." (Sec. 2 Pt. b. S 702, 78th Congress.)

[1] *New York Times*, January 3, 1943.
[2] *The Chemist*, April, 1943, Vol. 20, 227, 1943.
[3] *New York Times*, April 24, 1943.

When Dr. Dunn makes the statement quoting[4] data of 1942 that there are "thousands of biologists of all kinds, of geologists, of mathematicians, and other scientists whose work has no immediate relation to the war," we again cite Laurence, who reports that there are now "87 per cent. of the mathematicians and 83 per cent. of the biologists in the research field who are now directly engaged in research problems in connection with the war."

When Dr. Dunn questions the truth of "There are no secrets in the oil industry for the duration" he has ignored completely the Honorable Harold L. Ickes, Petroleum Administrator for War, who addressed the American Petroleum Institute in Chicago on November 11, 1942, when he stated:

> You accepted our idea of district committees representing the industry through the country to consult with and advise us on the problems of producing, refining, transporting, marketing and conserving oil. As a result we have had, for more than a year, approximately three hundred of the leaders of your industry working continually with us in the multifold and worrisome task of making that priceless commodity do its part first in defense and now in war.
>
> The cooperative idea took hold. It worked. It worked so well that during the fall we decided to carry it further. The district committees had functioned adequately on regional matters, but an increasing number of our problems had national ramifications that called for a grouping which could operate on a national scale. Realizing this, I appointed seventy-two leaders of the industries as what is now known as the Petroleum Industry War Council. As in the case of the industry committees it represents both large and small interests. On it also are representatives of oil associations and cooperatives.
>
> This council was appointed on November 28, 1941, and the first meeting was held ten days later; and thus wholly without premonition even if I was responsible for what a member of the Council termed one of the great coincidences of history. The first meeting was held the day after Pearl Harbor. The President had not yet gone before Congress to ask for a formal declaration of a state of war but every man present sensed that the oil industry had already mobilized for a war in which the future of America itself was at stake. Around the table were the big names of the industry, heads of powerful integrated companies whose plants are familiar to every motorist. Yes, and also around the table were the leading independents and with them men whose names the average citizen would not recognize if he heard them—names that meant that the little fellows had just as much voice in the councils as the so-called majors.
>
> It is no military secret that in the summer of 1941, we were dangerously short of the capacity for making 100 octane (gasoline). Our production at that time, as you know, was only about 40,000 barrels a day and one four-motored bomber can use several barrels in a single hour of flying.

[4] J. S. Nicholas, *American Scientists*, 30: 297–298, 1942.

I wish that I might make public as a tribute of your industry the present production of 100 octane because it represents a near miracle, the proportions of which can not unfortunately be appreciated by anyone who does not understand the intricacy of the refinery equipment which is necessary and the complications of processes involved. It has been achieved because we have had a smoothly functioning government-industry partnership. Because the holders of patents of complicated processes which have been developed over many years at huge expense agreed to make those processes available at sharply reduced royalties to all who would participate in the effort. Because the experts of our office and those of your industry together work wonders in improving processes and in devising ways to avoid the use of scarce materials. Because rival companies were willing to share with one another their raw materials, their knowledge and their facilities. Because, in brief, there was the will to do and the organization to do it.

As one who has worked on many projects of which the Honorable Harold L. Ickes is speaking, I know that there are no "secrets in the oil industry for the duration."

Dr. Dunn questions the motives in back of my opposition to the Kilgore bill and asks, "Is it concern for the public good or for corporation profit?" My answer is both. I believe we still live in a free enterprise system and that this system has made the United States the great country it is, and much of this greatness is based squarely on the patent system.

He quotes only the title to Section 7 "Protection of the Public Interest in Discoveries and Developments Financed by the United States." Section 7 (a) reads as follows:

> Any provision of law to the contrary notwithstanding, the Office is hereby vested with the exclusive right to use, and with the exclusive right to license others to use, (1) any invention, discovery, patent, or patent right which has heretofore resulted, or shall hereafter result, from research or invention for the carrying on of which the United States or any department, agency, or establishment thereof either has heretofore contributed at any time since the declaration of national emergency on May 27, 1941, or shall hereafter contribute, any money, credit, physical facilities, or personnel; and (2) any invention, discovery, patent, or patent right which is at the time of the enactment of this Act, or shall hereafter become, to any extent the property of the United States or of any department, agency, or establishment thereof.

As I understand this paragraph, it means that if the United States Government invested but $100 or furnished a single piece of equipment, or one individual with six months or more experience, it would have the rights to the patents, etc., flowing from the institution which has been assisted to that extent.

Dr. Dunn suggested that the directors of the American Chemical Society were biased when they stated that the Kilgore bill would "confer totalitarian powers." As a member of the American Chemical Society, I am in wholehearted agreement with the action of its directors. I have known each and every one of the directors of this society for many years and they are men of unimpeachable integrity.

My understanding is that other scientific and technical societies have opposed the Kilgore bill. Some of them are The American Electrochemical Society, American Institute of Chemical Engineers, American Institute of Mining and Metallurgical Engineers, The American Association of Engineers, The American Institute of Chemists, The National Society of Professional Engineers and the American Society of Civil Engineers.

GUSTAV EGLOFF,
President, American Institute of Chemists

RADIONICS

RIGHT now the public is being confused in the press and on the radio daily by two terms which mean exactly the same thing—"electronics" and "radionics." Electronics is of British origin and radionics has been used in our own country for some time, although I don't know who originated it.

Both these terms deal with the application of vacuum tubes in electrical circuits not only for broadcasting and radio communications, but to radio receivers, television, radar, photo-electric units, rectifiers, phonographs, hearing-aids and other devices comprising this entire field.

Let's take a quick look at these two words.

"Radionics" springs from the Latin "to radiate" and the Greek "ion" (to wander or travel) and thus we get the term "wandering or traveling radiations," which is much to the point and extremely descriptive.

The first syllable of "electric," "electricity," "electronics," springs from the Greek root meaning "amber," which they discovered had certain properties when rubbed. Therefore I take it electronics is wandering amber. Is that descriptive?

The term "electron," as thought of to-day, is of British origin, having been first used by C. J. Stoney in 1891. Since we did not adopt the British words petrol, underground, bobby, pub, valve and wireless, but instead are using the Americanisms—gasoline, subway, cop, saloon, tube and radio, why should we adopt the word "electronics"?

Incidentally, in the early days of radio, the same confusion existed in the American public mind between radio and wireless as now exists between radionics and electronics.

Even the physicists have said, "Radionics is more descriptive." Dr. Arthur F. Van Dyck, president of the Institute of Radio Engineers, said at the Chicago annual dinner of the institute on December 18 last: "Recently I heard a term for these new radio fields which seems apt. It is 'radionics.' That seems to be

a good term if we want to find one which will win friends and influence people."

My point is, we have a good American word in "radionics," highly descriptive, looked upon with favor by engineers and physicists, and easily understood by the general public. A word that, in my opinion, is fit to describe the miracles now being wrought behind the secret panels of radionic laboratories—wrought for the winning of the war. A word that includes the entire field of radar, electronics and radio in one covering term.

Over the long distance telephone in the past few days I have talked with most of the leaders of the industry, and of the two terms all of them seem to feel the American term "radionics" is more descriptive and will be less confusing to the public.

For the sake of our entire industry I would be deeply interested in the reaction of the press. May I have your opinion?

E. F. McDONALD, JR.

MAKING MOSQUITO SURVEYS WITH A JEEP AND THE PBY-5

THE Patrol Bomber (PBY-5) and particularly the Jeep have been found indispensable in carrying out mosquito survey work at the U. S. Naval Air Training Center near Corpus Christi, Texas.

The success of the Jeep lies in its ability to go anywhere. She can wade through water that covers the floor boards, or scoot through brush that is higher than the car. Her four-wheel drive mechanism pulls her over sand dunes or through axle-deep mud. Throughout the design of the Jeep all waste space has been eliminated, but two men with collecting and camping equipment can successfully live out of her for days. Many successful reconnoitering survey trips have been made that included four individuals.

For the preparation of the survey map, it was found that a drawing board measuring 20 × 36 inches could be built into the rear seat. Each end of the board rests on the fender frames. A piece of 2 × 4 or 2 × 6 board is attached to the under side of the drawing board where it not only acts as a stop to keep the board from shifting, but raises it up to a more desirable level for drawing. Drawing paper can then be thumb-tacked to the board or sealed with decorator's self-sealing tape.

This type of arrangement has worked successfully in the preparation of maps in which the scale has been 2 or 4 inches equal to 1 mile. Thus, by means of the speedometer readings, compass, protractor and ruler, the location of the ponds, lakes, marshes, roads, creeks, etc., can be accurately plotted. It was found that there was no incorrect degree of deviation of the compass when it was held in the center of the drawing board. The mosquito breeding places have been located and plotted in an area of over 100 square miles in less than a week by the use of this method.

At many times, it is desirable to see the extent of the mosquito breeding area from the air, and for this the PBY-5 has been most frequently used. This ship is equipped with so-called "glass blisters" in the fuselage. This has the advantage of permitting one to see the ground in all directions. The PBY-5 is capable of flying at low speeds and from an altitude of 100 feet, detailed examination of the ground can be made and sketch maps prepared.

WILLIAM M. GORDON

U. S. NAVAL AIR STATION,
CORPUS CHRISTI, TEXAS

DR. A. W. GRABAU IN CHINA

THE following communication from Mrs. Amadeus W. Grabau (Mary Antin) will be of interest to many geologists. Dr. Grabau, who has long been engaged in paleontological work for the Chinese government, is still living in Peking.

In November I received a very short letter dated August 4, 1942, in my husband's own hand. He stated briefly that he and his household were getting along tolerably well with the help of a subsistence allowance from our State Department which, as you probably know, all American nationals in enemy territory receive through the nearest Swiss representative. This letter was brought out of Peking by a friend, Dr. A. B. D. Fortuyn, who came out with the first lot of various nationals to be exchanged.

Later I called upon Dr. and Mrs. Fortuyn in New York. They gave me a reassuring picture of my husband. When they last saw him in August (1942), he was in no worse health than he had known for years past and was able to concentrate in his usual energetic fashion on his writing. Publication is of course very doubtful now, but at least there is no interference with his writing. His current secretary-housekeeper, a German lady—one of a succession of refugees whom Dr. Grabau has sheltered in his compound from time to time—seemed to be efficient and devoted. Some of his Chinese friends are still at hand to look after him as in years past. Also Dr. Hoeppli, formerly on the staff of Peking Union Medical College, now representing the Swiss government to look after American citizens in Peking, is well acquainted with my husband and sure to look after him.

General conditions in Peking were not too bad. The food situation was tolerable as of early August. American citizens, with the exception of two or three administrative officers of P.U.M.C., had the freedom of the city and were carrying on pretty much as in former days. My husband was left undisturbed in his own compound with a sufficient domestic staff.

A significant item was relayed to me by Dr. Roger S. Greene. In a news letter from Chungking dated November 10, 1942, was the following reference to my husband: "Professor Grabau has been given $6.00 local currency a month by the Japanese in token of their recognition

and appreciation of his scientific contribution to the theory of Pulsation.''

In the opinion of Dr. and Mrs. Fortuyn, my husband would not be able to make the journey under present traveling conditions, if he were offered the opportunity to be exchanged.

HERVEY W. SHIMER
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SCIENTIFIC BOOKS

TEXT-BOOKS OF PHYSICS

A Laboratory Manual of Experiments in Physics. By L. R. INGERSOLL and M. J. MARTIN. 5th edition. xi + 342 pp. McGraw-Hill Book Company. 1942. $2.50.

General Physics for the Laboratory. By L. W. TAYLOR, W. W. WATSON and C. E. HOWE. Revised edition. vii + 184 pp. + 107 record sheets. Ginn and Co. 1942. $2.00.

A Laboratory Manual of Electricity and Magnetism. By LEONARD L. LOEB. Revised edition. xii + 121 pp. + experiment data sheets. Stanford University Press. 1941. $1.90.

University Physics, Part III, Light. By F. C. CHAMPION. 172 pp. London and Glasgow: Blackie and Son, Ltd. New York: Interscience Publishers, Inc. 1941. $1.50.

College Physics. By A. W. DUFF and MORTON MASIUS. x + 588 pp. Longmans, Green and Co., Inc. 1941. $3.80.

College Physics. By HENRY A. PERKINS. Revised edition. xi + 802 pp. Prentice-Hall, Inc. 1943. $4.50.

A Survey of Physics for College Students. By FREDERICK A. SAUNDERS. Third edition. xii + 724 pp. Henry Holt and Co., Inc. 1943. $4.00.

Physics. By FRANK L. ROBESON. ix + 819 pp. The Macmillan Company. 1942. $4.50.

Introduction to Physics. By HARLEY HOWE. xii + 559 pp. The McGraw-Hill Book Company. 1942. $3.75.

Analytical Experimental Physics. By H. B. LEMON and MICHAEL FERENCE, JR. xvi + 584 pp. 66 plates. 584 zincs. University of Chicago Press. 1943. $7.00.

THE first three books on the list are laboratory manuals of real merit.

Ingersoll's "Experiments" appeared in a modest first edition almost two decades ago. It established a clientele. Professor Martin joined in preparing the third edition. Through successive editions the manual has been enlarged and enriched and now ranks with the best available.

"Taylor, Watson and Howe" appears in a revised edition after sixteen years of successful use. New experiments have been added; old ones have been brought up-to-date. The M-K-S units are now used throughout. One hundred and seven pages of "Record Sheets" have been added. These innovations will encounter warm friends and ardent foes.

For years the reviewer has recommended a short list of "manuals" to his pupils in general physics. "Ingersoll and Martin" and "Taylor, Watson and Howe" have been on the list. Could not an effective course in general physics be offered with a manual like either of these, perhaps reshaped a little, as the core text-book with a shelf of the usual texts in general physics at hand for collateral reading?

Professor Loeb's "Manual of Electricity and Magnetism" presents in 120 pages twelve admirable experiments chosen to supplement the author's course, each presented in great detail. There follow at least 200 pages of "Experiment Data Sheets." The treatment follows conservative and classical lines proceeding from magnets and magnetic fields to current, potential difference, resistance and so on.

The "soul of the book" is revealed in its twelve pages of "preface" and "announcement." The reviewer pauses to salute the loyal teacher who wrote them. The manual has been written, says the author, in an attempt "to put into practice certain ideals of laboratory instruction gleaned from his years as a student teacher." The author proposes so to plan and to conduct his laboratory instruction that the work of his pupils will automatically rise to a high level of laboratory ethics. May the author's kind increase! And may his ideals motivate all instruction everywhere!

Up from mighty London comes Part III, "Light," of Professor Champion's "University Physics." Packed into thirteen chapters and 172 pages are the essentials of optics. Numerous illustrations, well drawn and aptly chosen, illuminate the text. Questions and numerical exercises follow each chapter. A list of seventy-five examples closes the book. This text should receive serious consideration for a one-semester course at the second-course level.

The rest of the books, six in all, are texts for the general college course. Each author has written the "Thing as he sees it for the God of Things as They Are," for teachers as they are and for students as they are supposed to be. What an array of boundary conditions! Small wonder that the solutions are so varied.

Perhaps never before have texts been so critically scrutinized, for are not most of these on the list of texts recommended for the "basic courses" of the

Army and Navy? Thousands and tens of thousands of young men who neglected to conquer General Physics while in civilian clothes must now face him in uniform in preparation for encounters with foes that are still more formidable.

None but the oldest oldsters can recall the days before there was a "Duff's Physics." And it now seems altogether likely that youngsters yet unborn will study "Duff" in their turn. Let's create a list of the perennial texts with Duff's "Physics" at the top. Its lucidity, thoroughness, meticulous accuracy and usableness have been recognized for decades. And now Professor Masius joins Professor Duff in a revision of Duff's "College Physics." "Vitai lampada tradunt."

Perkins's "College Physics" has gone through six printings and an "abridged edition" in five years, and now is issued as a revision. The author has been alert to opportunities to improve his original text. New problems, without answers, have been added to match the original ones, with answers, which are retained. New topics have been added, and some old topics have been rewritten. The claims that the book is meaty, thorough, sound, conservative and attractively written are in accord with the reviewer's personal experience in using it. For instance, compare Perkins's treatment of "Waves" with run-of-the-mine treatments. This book has earned a place for itself.

Saunders's "Survey of Physics" has been in use for thirteen years. The third edition has just appeared.

One envies the student who uses this text. One reads, and reads on, just for the joy of reading English that says things so frankly and clearly, so convincingly, so attractively—even humorously at times. The illustrations are right to the point. And the paragraphs in fine print present interesting topics, such as: "the fission of uranium," "the ultra-red telescope," "theories of magnetism," "Foucault's pendulum." The recommended reading includes the old classics and the latest word—"Heat as Mode of Motion" and "Phenomena at the Temperature of Liquid Helium"—side by side.

The M-K-S system is put in fine print as a proposal of merit and promise, to be learned along with the other systems.

He who masters this "Survey" learns a lot of solid, live and growing physics.

Robeson's "Physics" and Howe's "Introduction to Physics" made their bows during the past year. A preliminary examination of both books reveals all the signs of texts well written. All the old familiar landmarks are preserved, and the new find their places among the old. As in Duff and Masius and in Perkins and in Saunders the M-K-S system is recognized and is given its place. It supplants nothing. Time only will decide the place it will occupy. Both Robeson and Howe are to be commended for many original and striking ways of presenting old concepts and familiar principles. The reviewer could use either text with confidence.

For the reception of Lemon and Ference's "Analytical Experimental Physics" the reviewer's mind had been conditioned by "From Galileo to Cosmic Rays" and by "Cosmic Rays so Far." Imagine then his surprise when handed five pounds, 250 cubic inches and seven dollars worth of book! And between the covers one finds good straightforward physics, at an advanced undergraduate level, set forth with unusual clarity in great detail and beautifully illustrated with diagrams, photographs and strips from motion picture films. This book invites perusal. It promises to be worth all that it costs, all the space that it occupies, and all the effort required to lift it and carry it.

For some years past consistent effort has been made at the University of Chicago to bring the students into more intimate contact with physical phenomena by the use of moving pictures and of the demonstration laboratory. And now the moving pictures and the demonstration laboratory have been put, in part at least, between the covers of a book.

When the reader opens Lemon and Ference he steps into the presence of the phenomena, and on the printed page he reads the language, the equations and the graphs that men employ when thinking and speaking about the phenomena. Has there not appeared a new and a significant development of the art of writing text-books?

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MAN AND HIS PHYSICAL WORLD

Man and His Physical World. By DWIGHT E. GRAY. Van Nostrand, 1942. 665 pp. $3.75.

THIS is a remarkable book. If I had to describe it in a single phrase, I should say that the author has managed to be encyclopaedic without being ponderous, no mean achievement! The mere scope of the book is startling. I can give a notion thereof in no better way than by listing the chapter-titles, numerous as they are: Science and the Scientific Method—The Solar System—The Universe Beyond the Solar System—Astronomical Measurements—The Earth as an Astronomical Body—Factors Which Change the Surface of the Earth—Clues to Earth History—Geological History—Numbers and Number Systems—Units of Measurement—The Nature of Matter—Air and Water—Fuels—Metals and Alloys—Colloids and Rubber—Synthetics—Force, Work and Power—Energy and Its Transformations—Heat Engines—Magnetism—Static Electricity—Current Electricity—Electricity

and the Atom—Wave Motion—Sound—Light—Communication — Illumination — Refrigeration. Such a book would be expected to proceed from the conjoined efforts of many professors, or if from one, then from the occupant of a chair in General Science and Engineering or in "Natural Philosophy" of the eighteenth-century sense. Mr. Gray is designated as an Associate Professor of Physics (in the University of Akron) but I suspect and hope that his lectures range over a wider field.

The style is conversational, at times even chatty, with flashes of humor. Among the sections which I found most readable are the chapters on the solar system, the passages on the atmosphere and on weather (tucked away in the chapter oddly entitled "Factors Which Change the Surface of the Earth"), the chapters on fuels, on alloys and on synthetics including plastics, and that entitled "Heat Engines" and devoted largely to the automobile. Another reader would probably make another selection, depending upon the distribution of his interests and of his ignorances: it would be difficult to find a reviewer capable of making an impartial judgment, for he would have to bring an equal interest and an equal state of knowledge to every subject, and probably no such person exists.

There is a rather depressing joke to the effect that an encyclopaedia is a book of which one likes the treatment of every subject except one's own. The errors which I find in the treatment of physics do not vitiate the book, but they do suggest that in the to-be-hoped-for second edition each part should be submitted to the inspection of a narrower expert. Cohesive forces between molecules do *not* vary inversely as the square of the distance; a liquid may be denser than the solid into which it freezes; the constituents of a mixture do not boil off individually and completely at the respective temperatures at which they would boil if pure; Franklin's kite experiment is now regarded by the historians as a myth; the reason given for believing that e/m is the same for all electrons is not a valid reason; the nuclear atom-model was invented by Rutherford and also by Nagaoka, but not by Bohr; there are several natural radioactive substances lighter than lead, and *all* elements can be obtained in radioactive forms, not "just a few." I could go on like this, but do not wish to leave the impression that the flaws are more numerous than the right statements, a danger which reviewers often incur. The difficulty is that correct statements are not news.

Some passages which I marked for favorable quotation are: the very timely reference to the 1886 Commissioner of Labor who stated "in his annual report that . . . the next fifty years would see no such advance as the previous half century"; the clever definition of plastics, including the phrase "only man can make a plastic"; the definition of force in the words: "Our purposes in this discussion will be adequately served if we define force simply as 'push or pull.' The fact that the definition contains only words of one syllable may keep it from sounding very impressive, but it covers the ground satisfactorily." And again: "An individual whom we describe as having a great deal of energy is one whom we think of as being able to accomplish a lot. Very much the same idea is involved in the scientific definition which states 'Energy is the capacity for doing work.'" And to terminate: "Radio-active disintegration is somewhat as though a large brick factory building should shoot out a lot of bricks and become a theater, which after a time would emit more bricks and settle down into a dwelling-house, which later on would repeat the procedure and continue its existence as a hamburg stand."

I hope that these remarks and quotations will entice many to read this book. It remains to be said that there are many striking photographs, and that for the benefit of those who wish to test their absorptive powers and their memories the author has supplied after each of the chapters a multitude of questions, classified as "Discussion," "Multiple-Choice," and "True-False."

KARL K. DARROW

SOCIETIES AND MEETINGS

THE KANSAS ACADEMY OF SCIENCE

THE seventy-fifth annual meeting of the Kansas Academy of Science was held at Lawrence, Kansas, on April 10, with Dr. Raymond H. Wheeler, University of Kansas, Lawrence, Kansas, presiding. The affiliated society, The Kansas Entomological Society, met with the Academy. Other state societies which held their meetings in cooperation with the Academy were The Kansas Association of Teachers of Mathematics and the Kansas Chapter of The Mathematical Association of America.

This was the Diamond Jubilee Meeting of the society, the first meeting having been held in 1868. Originally it had been the intention to celebrate this milestone along the lines of the Golden Anniversary held in Lawrence in 1918, but such plans were abandoned and this meeting, shortened to one day, was conducted in a conservative manner. The goal was a vigorous, effective meeting to maintain the virility of the organization without handicap to the war effort.

During the morning, section meetings were held for Biology Teachers, Botany, Chemistry, Geology,

Physics, Psychology and Zoology. No attempt was made to hold a section of the Junior Academy but local chapters had been encouraged to hold meetings at which the outstanding demonstrations, papers and exhibits were selected. These were brought to the state meeting and judged.

Saturday afternoon was devoted to a symposium on "Science and the War Effort," in which nine persons qualified to represent their respective fields, related the activities of that field to the war. The following fields were represented: Agriculture by Dean L. E. Call, Kansas State College; Bacteriology and Medicine by Dr. Noble P. Sherwood, University of Kansas; Botany by Dr. Paul B. Sears, Oberlin College; Chemistry by Dr. John W. Greene, Kansas State College; Entomology by Dr. H. B. Hungerford, University of Kansas; Geology by Dr. John C. Frye and C. Philip Kaiser, State Geological Survey; Physics by Dr. J. Howard McMillen, Kansas State College; Psychology by Dr. H. B. Reed, Fort Hays Kansas State College; Zoology by Dr. John Breukelman, Kansas State Teachers College, Emporia. The society plans to publish these talks in the current volume of its Transactions.

The Constitution was amended to add two sections. The first decreed that the Academy shall have a librarian to be elected annually; the second that the chairman of the Junior Academy of Science shall be elected for a period of three years and be a member of the Executive Council.

The annual banquet was held on Saturday evening, President Harvey A. Zinszer presiding as toastmaster. The address of welcome was given by Chancellor Deane W. Malott of the University of Kansas. A program in keeping with the spirit of the meeting was conducted. Dr. E. S. Riggs, formerly of the Field Museum of Natural History, an honorary member, gave a word of congratulation to the society from this group; and greetings were voiced by Dr. Julius T. Willard, formerly dean of science at Kansas State College, for the life members. The secretary read the names of 20 persons who had been annual members for 20 years or more that had been elected to life membership to commemorate this milestone in the history of the society. Many of these persons were present at the banquet. Dr. Raymond H. Wheeler, the retiring president, read numerous messages from older life members who were unable to be present and then gave the address of the retiring president entitled, "Climate and Human Behavior History."

The banquet was followed by the annual public meeting. The program for this occasion consisted of an invitational address by Dr. Paul B. Sears, head of the department of botany of Oberlin College, and a noted ecologist. His subject was, "The Ecology of Peace." It was a timely discourse at this stage of our war torn world.

TABLE I

SECTION RECORD, WITH PAST AND FUTURE OFFICERS—LAWRENCE MEETING

Name of section	Chairman for 1943	No. papers on program	No. persons attending	Chairman for 1944
Biology Teachers	Sherwin B. Griswold	4	15	J. Ralph Wells
Botany	Andrew Riegel	15	30	S. M. Pady
Chemistry	J. Wilbert Chappell	13	45	Worth A. Fletcher
Geology	H. T. U. Smith	10	15	W. H. Schoewe
Kansas Entomological Society	H. B. Hungerford	9	35	Robert Bugbee
Kansas Chapter of Math. Assoc. of Am.	C. F. Lewis	9	55	Paul Eberhart
Kansas Assoc. of Teachers of Math.	Daniel B. Pease	9	55	H. H. Bishop
Physics	W. D. Bemmels	8	26	C. V. Kent
Psychology	O. W. Alm	11	32	Maurice C. Moggie
Zoology	Jacob Uhrich	17	34	Dorothea S. Franzen

The Academy registration was 185. The reports from the section chairmen on their sections is presented herewith in Table I.

The next annual meeting of the Academy will be held at the Washburn Municipal University of Topeka if plans can be perfected to that end; otherwise at Kansas State College, Manhattan, Kansas.

The following officers were elected for the next year and meeting: President, Harvey A. Zinszer, Fort Hays Kansas State College; President-elect, L. D. Bushnell, Kansas State College; Vice-president, John W. Breukelman, Kansas State Teachers College, Emporia; Secretary, John C. Frazier, Kansas State College; Treasurer, F. W. Albertson, Fort Hays Kansas State College; additional Executive Council members, R. H. Wheeler, University of Kansas; Claude Hibbard, University of Kansas; A. C. Carpenter, Ottawa; and Edith Beach, High School, Lawrence. W. J. Baumgartner of the University of Kansas was re-elected Managing Editor of the *Transactions* for a period of three years. Paul Murphy of K.S.T.C., Pittsburg, was elected an Associate Editor for a term of three years. Roger C. Smith of Kansas State College was re-elected as delegate to the academy conference for one year. Donald J. Ameel of Kansas State College was re-elected Librarian. Miss Edith Beach of Lawrence High School was elected secretary of the Junior Academy for a three year term.

JOHN C. FRAZIER,
Secretary

MANHATTAN, KANSAS

PENNSYLVANIA ACADEMY OF SCIENCE

THE regular spring meeting of the Pennsylvania Academy of Science was held in Harrisburg on April 2 and 3. Because of the emergency, the usual evening dinner was omitted and the session curtailed. Nevertheless, about 200 persons attended. The evening of the second was opened with papers by Dr. William L. Rhein and Dr. John M. Fogg, Jr., on natural history, particularly as applied in Pennsylvania. On the third, the customary procedure was changed. Instead of the reading of many papers by the members, a few selected papers were read which in their entirety were in the nature of a symposium on research and the status of science education. President Charles E. Mohr presided. The following officers were elected: *President,* C. A. Horn; *President-elect,* Homer C. Will; *Vice-presidents,* Bradford Willard and Leroy K. Henry; *Editor,* E. M. Gress; *Secretary-Treasurer,* V. Earl Light; for the Junior Academy, Mary E. Hawthorne.

BRADFORD WILLARD

SPECIAL ARTICLES

THE CULTIVATION FROM GRANULOMA INGUINALE OF A MICROORGANISM HAVING THE CHARACTERISTICS OF DONOVAN BODIES IN THE YOLK SAC OF CHICK EMBRYOS[1]

IN spite of careful work by a number of investigators no agent acceptable as the etiologic factor of granuloma inguinale has as yet been cultivated. Recent reports by Dienst, Greenblatt and Sanderson,[2] by Greenblatt, Dienst, Pund and Torpin[3] and by Carter, Jones and Thomas[4] agree that the agent is not cultivable on a wide variety of media known to be useful for the cultivation of certain fastidious pathogenic microorganisms. Ordinary experimental animals are resistant to infectious material from natural lesions. Neither of the above groups of workers was able to cultivate the agent on the chorioallantois of chick embryos. Greenblatt and his associates were able to reproduce the infection in human beings with material containing Donovan bodies apparently free from contaminants. They concluded that the Donovan body is the etiologic agent, that it is not related to the Friedlander-aerogenes group of bacteria and has not been propagated outside the human body.

This paper reports the cultivation in the yolk sac of living chick embryos of a microorganism that has all the morphological characteristics of the Donovan organism and is as yet neither cultivable on ordinary culture media nor pathogenic for mice, dogs or monkeys.

Tissue from a human lesion especially rich in Donovan bodies and with remarkably little evidence by smear of contamination with bacteria was obtained by Dr. W. A. DeMonbreun from a patient at the Nashville General Hospital. Small bits of this tissue were smeared over the surface of cystine agar slants subsequently incubated at 37° C. After 96 hours two slants appeared free of any bacterial growth. Smears showed the presence of a few gram-negative bipolar forms seemingly closely associated with degenerating tissue. These microorganisms appeared to be viable. There was little or no evidence that they had multiplied on the slant. They were not unlike non-encapsulated Gram-negative forms characteristically associated with Donovan bodies in granuloma inguinale lesions.

Each uncontaminated cystine slant was washed with 3 cc .85 per cent. NaCl; the washings were pooled and .5 cc was inoculated into the yolk of six 8-day-old embryos. On the third day two embryos, dead without evidence of bacterial growth, were discarded. Smear from the yolk of one live embryo at this time did not show evidence of bacterial growth. On the eighth day smears from the yolk of each of the four remaining living embryos, stained with Wright's and Gram's stains, revealed the presence in abundance of both encapsulated and non-encapsulated Gram-negative microorganisms indistinguishable from Donovan bodies and from those pleomorphic Gram-negative non-encapsulated forms always present in lesions of granuloma inguinale.

Subcultures of the microorganism present on the original cystine slants to other cystine slants did not grow. The microorganism present in the yolk sac of embryos has repeatedly failed to grow on enriched blood media, potato-dextrose-agar, anaerobic broths and meat, Loeffler's slants and egg-yolk slants.

As far as we could determine these original yolk sac cultures were pure and the microorganism has been uninterruptedly and easily cultivable in the yolk sacs of living chick embryos through 25 successive passages during a period of three months.

Transfers have been made by drawing infected yolk from its sac with a needle and syringe and injection

[1] This work was aided by a grant from the John and Mary R. Markle Foundation.

[2] R. B. Dienst, R. B. Greenblatt and E. S. Sanderson, *Jour. Infect. Dis.,* 62: 112–114, 1938.

[3] R. B. Greenblatt, R. B. Dienst, E. R. Pund and Richard Torpin, *Jour. Am. Med. Asn.,* 113: 1109–1116, 1939.

[4] Baynard Carter, C. P. Jones and W. L. Thomas, *Jour. Infect Dis.,* 64: 314–316, 1939.

of .2 to .5 cc into the yolk sacs of other embryos. Embryos of various ages were used and transfers were made at various intervals following inoculation.

The morphology of the microorganism varies depending somewhat more upon the age of the embryo from which the smear is made than upon the duration of the infectious process. Cultures from early generations showed mixtures of encapsulated and non-encapsulated forms. As passages increased smears from older embryos showed predominantly unencapsulated forms while smears from young embryos showed a predominance of encapsulated ones. Experience has determined that inoculation of 5- or 6-day embryos into the yolk yields consistently in 72 hours a rich culture that is almost wholly encapsulated. The encapsulated form has been maintained in series. This form inoculated into 12-day embryos grows out largely unencapsulated. Embryos from 1-through 13-days incubation support subsequent development of infection following inoculation into the yolk sac. Our experience indicates that the yolk of every embryo inoculated (700–800) has yielded a growing culture.

This microorganism grows evidently extracellularly in the yolk of the embryo. Smears and histological sections also show that it occurs both in its encapsulated and unencapsulated form inside epithelial cells of the yolk sac membrane, also within mononuclear cells of inflammatory exudate in the yolk and its sac. Notwithstanding direct inoculation evidence that it grows on the chorioallantois or invades the embryo proper from the yolk sac is as yet lacking. Inoculation into the amniotic fluid of the intact embryo seems to support growth feebly.

Infected yolk of the 10th passage was drawn from the embryo and stored in sealed test tubes at 5° C, 25° C, 37° C and at −78° C. After 17 days stored yolk from the first three groups was diluted 50 per cent. with .85 per cent. NaCl and injected in .5 cc amounts into 6-day yolk sacs. That stored at 25° C grew out promptly in 72 hours; that stored at 5° C and at 37° C grew slowly, but all embryos showed a good growth at the end of a week. Similar tests for survival made at the end of 33 days showed that the microorganism survived only at 25° C. Yolk stored at −78° C has not yet been tested for survival of the organism.

Mice inoculated intraperitoneally showed no evidence of infection. Dogs inoculated intra- and subcutaneously have not yet shown evidence of infection. *Macacus rhesus* monkeys were inoculated intra- and sub-dermally. Organisms resembling Donovan microorganisms were demonstrated by smears from nodules that persisted for 4 days, but the nodules regressed and have shown no further activity.

The fact that the microorganism appeared to grow in the yolk of the intact developing embryo made its culture in that medium *in vitro* seem feasible. Yolk alone from uninfected 5- and 6-day embryos in test-tubes did not support growth, but with the addition of bits of embryonic chick heart it gave a fairly good culture in 6 days at 37° C. After 2 serial passages in yolk-heart medium a subculture in yolk without heart was initiated. Strains have thus been maintained through ten serial passages *in vitro* during 7 weeks in yolk with and without heart.

Experiments are in progress at the present time to determine the relationship of this microorganism to the human infection, granuloma inguinale. A series of experiments to determine something of its antigenic relation to the disease is also being carried out. More detailed consideration of its morphological, cultural, antigenic and pathogenic characteristics will be the subject of further study.

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EFFECTIVENESS OF VITAMIN A IN THE TREATMENT OF DEFECTIVE COLOR VISION

SEVERAL reports have appeared in this journal durin the past year on problems of color-blindness, tests for color sensitivity and the value of vitamin A as a remedial agent in conditions of defective color perception.[1,2,3,4] The first suggestion that vitamin A could be used with effect in cases of impaired sensitivity to color was made in a report by Dunlap and Loken[5] before the Southern Society for Philosophy and Psychology. This was followed by the statement that cases were "cleared up" with vitamin A in from three to eight weeks, using doses of 25,000 units per day.[1] Later, these writers stated that 80 per cent. of their cases were able, after vitamin A treatment, to pass chart tests which they had failed previously.[3]

The practical importance of color vision has increased greatly since the beginning of the war. With well over a million men of draft age showing some degree of color deficiency, the possibility of salvaging even a small percentage of this man-power for the armed services or for vital work in industry was certain to attract attention.

Present knowledge of function of the visual receptors, plus the fact of a demonstrable hereditary

[1] K. Dunlap and R. D. Loken, SCIENCE, 95: 2474, 554, May 29, 1942.
[2] E. MURRAY, SCIENCE, 96: 2484, 133–5, August 7, 1942.
[3] K. Dunlap and R. D. Loken, SCIENCE, 96: 2489, 251–2, September 11, 1942.
[4] E. MURRAY, SCIENCE, 96: 2498, 448, November 13, 1942.
[5] K. Dunlap and R. D. Loken, *Psychol. Bull.*, 39: 585, October, 1942.

determinant and a tendency for color thresholds to remain constant under varied environmental conditions, indicated that the defect probably would not respond to vitamin treatment. However, until just ten years ago, we were not fully aware of the intimate and essential role of vitamin A in the normal function of the rods. The discovery of the relationship between vitamin A and rhodopsin could suggest that it might also be required in some similar but unknown way by the cones.

Following the first report by Dunlap and Loken, some preliminary observations were made on 16 college students who had defective color vision. Most of them had failed to pass tests of the Army Air Corps, but were quite anxious to do so. Three tests were used with this group: the Ishihara, the American Optical Company's pseudoisochromatic plates and the Westcott lantern slide, which is a modification of the yarn test principle for the purpose of group testing. Vitamin A (as purchased locally in the form of concentrated fish oil) was given to these subjects in doses of 25,000 units daily for eight weeks or more. One of this group took 250,000 units daily on prescription of a local physician. Fourteen of these cases, including the one just mentioned, showed no improvement, but two of them finally achieved almost perfect scores. Both of these subjects subsequently passed the Army Air Corps tests and are now training in that service.

Had all these preliminary tests been negative, it is unlikely that further observations would have been made, but it seemed difficult at the time to account for the improved performance of these two individuals except as being a result of vitamin A treatment. In the light of the results reported below, it may be necessary to accept another hypothesis. It should be said, however, that the original defect in these two cases was of slight degree.

In order to check the possibility that some benefit could be derived from vitamin A by a few individuals, some extensive observations were made under more rigid conditions. Group tests of 897 R.O.T.C. freshman cadets at Louisiana State University showed 65 who had various degrees of weakness in color sensitivity. Individual tests were then given to 58 subjects who began taking 50,000 units of vitamin A on alternate days. This schedule was continued for eight weeks. After having taken 1,400,000 units, each subject was retested under the same conditions as before.

Because there are many reasons why subjects, especially those who are not volunteers, might fail to follow instructions for taking vitamin A, it was considered important that this part of the test be carefully supervised. Accordingly, the subjects were required to swallow the capsules at regular hours at a dispensing station.

No significant improvement in color sensitivity was shown by any individual in the group of 41 who finished the eight weeks period of treatment. Most of the records of response to the 62 plates of the American Optical and Ishihara tests were practically identical before and after taking vitamin A. The maximum improvement shown by any individual was a correction of three previous errors. The lantern slide test gave essentially the same results, although there was more variability in the responses. An analysis of the reliability of these tests and their value as a convenient means of detecting color "blindness" will be presented in a later report.

The procedure in the present experiment differed from that of Dunlap and Loken in a few respects. We used a large number of subjects of approximately the same age (median, 17 years, 9 months) and living under very similar conditions throughout the period of testing. We are able to assert positively that all subjects actually took vitamin A, because this was done regularly in the presence of the experimenter or an associate. The material used was a vitamin A ester of high potency, determined spectrographically and confirmed by bio-assay.

It may be concluded from these tests that vitamin A in doses of 25,000 I.U. daily for eight weeks fails to produce any significant improvement in color sensitivity. It seems improbable that administration of the vitamin for longer periods of time would change this result, although observations are being continued on several subjects.

Murray[4] warns against the unfortunate consequences which could follow acceptance of vitamin cures for color deficiency until the permanency of results is thoroughly tested. The present study does not entirely dispose of the possibility that a few men, perhaps with minor color vision defects, may improve slightly; but the number who could use vitamin A for this purpose is so small as to be negligible. We need not, therefore, be concerned about the numbers who can pass the test temporarily.

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VITAMINS IN DEHYDRATED SEEDS AND SPROUTS

THE common use of sprouted seeds in the diets of oriental peoples appears to rest on a sound nutritional basis, if we are to judge by the vitamin content of such food materials. It has already been reported that significant increases in the concentration of riboflavin, nicotinic acid and biotin occur during germination of

many kinds of edible seeds.[1] Wheat and barley show increases of thiamine during germination, but several other species appear not to change appreciably in vitamin B_1 content. The present brief report summarizes certain earlier data obtained on cereals, and presents some new observations for pantothenic acid, pyridoxine, folic acid and inositol in seeds and sprouts of several common species of edible plants.

The general methods of investigation which were reported earlier have been continued in this work. Seeds were germinated at 25° C in a greenhouse or in peat moss and after 5 or 6 days the whole plants, including seed, shoot and root, were harvested, washed clean and dehydrated at 70° C. The dormant seeds were dried in a similar manner. All dried samples were ground in a small Wiley mill, and aliquots were taken for assays. For determinations of pantothenic acid, pyridoxine, folic acid and inositol, 0.5 gm of dry material was placed in 30 ml of buffer solution at pH 4.5. The buffer solution containcd 3.75 gm glacial acetic acid and 5.0 gm anhydrous sodium acetate per liter. Twenty milligrams of papain and 20 mg of Taka-diastase were added to each half gram sample, and the mixture was incubated at 37° C for 24 hours. A few drops of benzene were used to inhibit growth of microorganisms. The digested material was heated in steam at 100° C for 30 minutes, made up to a volume of 50 ml, filtered with Super-cel in a Büchner funnel and subsequently extracted twice with ether. The filtration and ether extraction were adopted for the purpose of removing fatty substances which might have interfered with the microbiological assays.[2] Pyridoxine was assayed with a yeast growth method according to a procedure developed in the Yale laboratories.[3] The other vitamins were tested in accordance with methods published by R. J. Williams *et al.*[4] The losses in dry matter which occurred during germination were determined for the purpose of making certain calculations regarding the change in vitamin content. Vitamin values of the plant materials were corrected for errors introduced by the presence of small amounts of vitamins in the enzyme preparations.

A summary of the data obtained for four kinds of plants is presented in Table I. The ratio of dry matter in the dormant seeds to that found in 6-day-old sprouted seeds ranged in the different species from 1.06 to 1.33, indicating some loss in dry material in metabolic processes accompanying germination. The vitamins expressed as micrograms per gram of dry matter, show much greater gains in sprouting seeds than can be accounted for on the basis of increased concentration through loss of dry matter and mere maintenance of vitamins stored in the seeds. The data presented for riboflavin, nicotinic acid, biotin and thiamine are averages taken from experimental work reported in a previous paper. The observations on pantothenic acid, pyridoxine, folic acid and inositol, reported here for the first time, offer further evidence for the increase of vitamins during germination. It appears also that considerable differences in content of these vitamins exist among species. In addition to the kinds of plants listed in the table, certain others were also studied. Germinated peas and buckwheat showed gains in pyridoxine and folic acid ranging from 3 to 10 fold and smaller increases in pantothenic acid.

It seems probable that not all species may be expected to exhibit such increases in vitamin content as are indicated for the sprouting cereals. It would be desirable to have these preliminary determinations, which are based entirely upon microbiological assays, checked with other methods. The data obtained thus

TABLE I

VITAMIN CONTENT OF DORMANT AND SPROUTED SEEDS. MICROGRAMS PER GRAM OF DRY MATTER*

	Oats		Wheat		Barley		Corn	
	Dormant	Germinated	Dormant	Germinated	Dormant	Germinated	Dormant	Germinated
Dry matter mg per seed	19.3	14.8	28.5	21.4	35.6	30.2	315.0	271.3
Riboflavin	0.8	11.6	1.3	5.4	0.9	7.2	1.1	4.3
Nicotinic acid	7.5	44.0	62.0	103.0	67.5	115.0	9.5	39.5
Biotin	0.9	1.4	0.17	0.36	0.31	0.91	0.21	0.54
Pantothenic acid	7.6	21.9	7.6	12.6	5.4	10.0	4.2	7.7
Pyridoxine	0.3	1.8	2.6	4.6	0.2	0.5	0.7	0.8
Folic acid	22.0	143.0	28.0	106.0	14.5	50.0	10.0	45.0
Inositol	630.0	1290.0	1460.0	2100.0	1240.0	1370.0	800.0	1640.0
Thiamine	11.3	12.2	7.0	9.0	6.8	9.0	5.5	5.1

*The values are calculated as riboflavin, nicotinic acid, biotin methyl ester, calcium pantothenate, pyridoxine HCl, inositol and thiamine HCl. Folic acid is expressed as micrograms of concentrate having a potency of 3100, according to Dr. R. J. Williams, who so kindly supplied this vitamin material.

[1] Paul R. Burkholder and Ilda McVeigh, *Proc. Nat. Acad Sci., U.S.A.*, 28: 440, 1942.

[2] F. M. Strong and L. E. Carpenter, *Ind. Eng. Chem. Anal. Ed.*, 14: 909, 1942.

[3] Paul R. Burkholder, *Amer. Jour. Bot.*, 30: 206, 1943.

[4] R. J. Williams, University of Texas Publication No. 4237, 7, 1942.

far strongly support the view that many seeds gain in vitamin content during germination. Of considerable importance for animal and human nutrition is the fact that the vitamins which appear to be synthesized in sprouting seeds are preserved during subsequent dehydration.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE CONSTRUCTION OF TISELIUS ELECTROPHORESIS CELLS

INASMUCH as the attention of manufacturers of optical equipment is at present directed almost exclusively toward war production, the procurement of suitable cells for the electrophoresis apparatus of Tiselius has become a rather difficult problem. Because of the wide application of the Tiselius instrument to problems of biological and colloid chemistry it was thought that the experiences of the authors in constructing these cells might prove to be of general interest. The methods should also prove applicable to the construction of other types of glass cells.

The cells have been constructed of one eighth inch thick color-clear plate glass. After a little practice no difficulty was encountered in grinding the glass parts to the proper size on the face of a rotating iron disc fed with carborundum and water in the usual way. The rectangular holes in the horizontal plates were cut by grinding through the faces of the plates from both sides with the edge of a small iron disc mounted in a lathe and fed with carborundum. In this operation the glass was mounted on a plate hinged to the compound tool rest of the lathe. The holes were then squared up by hand with carborundum and a strip of metal. The horizontal sliding surfaces were ground flat on plate glass after the sections were assembled. The center sliding section was of the double length design described by Longsworth, Cannan and MacInnes.[1] It was assembled in two steps. First, the rectangular tubes were cemented and ground on the ends until square and of equal length. During the grinding the tubes were temporarily fastened together with beeswax. Second, the tubes and horizontal plates were assembled and cemented. The top and bottom sections were each cemented in a single operation.

The principal difficulty was, of course, the cementing of the glass parts. Numerous cements of various types were tried without success until a low-melting glass-like material described by von Angerer[2] was used. The cement is made by fusing together 5 parts of washed silicic acid, 16 parts of red lead (minium, Pb_3O_4) and 4 parts of calcined borax, using a blast lamp furnace. While still molten, the material was poured out into water, dried, ground fine in a Mullite mortar and put through a 500-mesh screen. The powder was mixed with water to form a thin paste, which was applied evenly with a brush to the surfaces to be cemented. After the cement dried the parts were assembled in a suitable steel jig, using weights to apply pressure to the joints, placed in an electric muffle furnace, and heated to about 500° C—approximately one hour was required for the furnace to reach this temperature. The proper temperature imparts a slight glow to the furnace, perceptible only in a darkened room. After three hours the furnace was turned off and allowed to cool, about six hours being required for it to reach room temperature. In designing the jig it was found that any metal part which touches the glass over any considerable area should be in contact with the entire glass surface, otherwise the metal conducts heat to local areas and cracks the glass. The joints frequently contain numerous small bubbles, but seem to be essentially as strong as the glass itself. If the cement has been applied evenly a tight seal is obtained.

Although no further polishing of the optical surfaces was attempted, the optical properties of the tubes have been found to be quite satisfactory. No irregularities could be observed in the base lines produced by the cells even though the Tiselius apparatus in use in this laboratory is a rather sensitive one. The joints have been found to be permanent and substantial. Preliminary experiments have indicated that pyrex glass may also be cemented by the same method.

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[2] Ernst von Angerer, "Technische Kunstgriffe bei physikalischen Untersuchungen," p. 48. Friedr. Vieweg und Sohn, Braunschweig, 1936.

[3] Fellow of the National Research Council.

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